Met Office

NEWS

Study shows power outage predictions in windstorms improved when accounting for multi-hazard effects

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Windstorms are the leading cause of major power outages in the UK, primarily due to windthrow - the uprooting or breakage of trees by strong winds - which then fall on overhead power lines.

Traditional risk assessments in the UK have focused solely on wind speed, overlooking critical factors that influence windthrow such as antecedent rainfall, wind direction, and seasonal elements like leaf cover. By analysing power outage data from 2006 to 2018, researchers have demonstrated that neglecting these additional factors can lead to a significant underestimation - by 2 to 5 times - of the likelihood of large power outages during windstorms.

The study, "Antecedent rainfall, wind direction and seasonal effects may amplify risk of wind-driven power outages", highlights that incorporating the additional factors into a statistical model, alongside wind speed, greatly enhances the predictive accuracy of power outages during windstorms.

For instance, the probability of outages is found to be 3-4 times higher in summer than in winter for the same wind speed, likely due to leaves on trees providing a greater wind loading; and 2-3 times higher in wet conditions, and when wind direction largely deviates from the prevailing southwesterly direction. This is because trees are more vulnerable to uprooting in such conditions. When all conditions align, the probability of power outages can increase 4-5-fold, especially at lower wind speeds.

Colin Manning, research associate at Newcastle University and visiting scientist at the Met Office, and report author said: "Windstorms have long been recognised as a threat to the UK's electricity distribution networks, which are vital components of the nation's critical infrastructure. Failures in these networks can cascade through other systems, affecting essential services.

"By taking the multiple weather conditions into consideration, we can significantly improve the accuracy of power outage predictions and can better prepare for the impacts of extreme weather events."

The research indicates the importance of understanding regional variability in the influence of these factors. Tree trimming practices, tree species, and soil characteristics can vary regionally, highlighting the need for localised risk assessments.

It also underscores the importance of understanding how these additional factors may change in a future climate, if we are to accurately project the changing likelihood of power outages in the future.

Professor Lizzie Kendon, Strategic Head of Climate Processes and Projections at the Met Office concludes: “This is the first UK study demonstrating the importance of additional factors affecting wind-driven power outages. Understanding how these factors will change, and including them in future risk assessments, is critical for accurately projecting the changing likelihood of power outages in future. Changes in the seasonality of storms and increases in heavy rainfall with warming, may act to compound the impact of strong windstorms in future.”

Met Office weather warnings are impact-based and designed to communicate the potential consequences of weather events, such as damage to infrastructure or risks to public safety, rather than just the meteorological conditions. This approach helps ensure that the warnings are more actionable and relevant, leading to better preparedness and response.

This research takes power outage resilience a step further, and could support accurate predictions of power outages, allowing for better preparedness and response strategies. Improved outage predictions could also help energy companies allocate resources more efficiently, reduce downtime, and enhance the resilience of the power grid.

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